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(54) **Transmitting/receiving apparatus for use in telecommunications**

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Appareil émetteur-récepteur pour usage en télécommunications

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- **PATENT ABSTRACTS OF JAPAN vol. 007, no. 088 (E-170), 12 April 1983 & JP-A-58 014695 (PILOT PEN KK)**

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Description

[0001] The present invention relates to a transmitting/receiving apparatus of the ear insertion type for use with handy phones, cordless phones, transceivers and the like.

[0002] When communicating through a communication apparatus such as a handy phone, cordless phone or transceiver, it is desirable to freely use hands to write a memorandum, to refer to notes, or to operate a personal computer. To this end, a transmitting/receiving apparatus as shown in Figure 6 has been proposed which comprises a headphone 27 and a microphone 29 supported by a support bar 28 in front of the user's mouth.

[0003] The transmitting/receiving apparatus of Figure 6 is satisfactory in terms of hand free usage. However, it is difficult to transmit a clear voice to the communication counterpart when the apparatus is used in a noisy place, for example, in a plant or vehicle, because the microphone 29 of the apparatus catches noise.

[0004] To solve this problem, Japanese unexamined Patent Publication No. 5-199577 (1993), for example, proposes a transmitting/receiving apparatus having an ear-insertion body 30 which incorporates therein an earphone 31 and microphone 32 of a bone-conduction type, as shown in Figure 7.

[0005] The transmitting/receiving apparatus shown in Figure 7 is advantageous in that it frees the user's hands and in that it can transmit a relatively clear voice because the main body thereof is inserted into the user's external auditory meatus and therefore the microphone 32 thereof does not catch external noise. Further, the microphone 32 catches a voice through bone conduction and, therefore, even a faint voice can satisfactorily be caught by the microphone 32.

[0006] However, the earphone 31 and microphone 32 are incorporated in a small main body and, hence, the microphone 32 catches acoustic vibration of the earphone 31. Since electrical problems such as howling and crosstalk occur in the apparatus, the volume of the earphone and the sensitivity of the microphone cannot be increased. Therefore, the apparatus cannot satisfactorily receive nor transmit a clear voice.

[0007] To solve this problem, a transmitting/receiving apparatus as shown in Figure 8 has been developed, in which an earphone 33 and a microphone 34 were separately provided, and the microphone adapted to utilize throat vibration was pressingly attached to the user's throat by means of a supported 35 wrapped around the neck.

[0008] The transmitting/receiving apparatus in Figure 8 is advantageous in that the microphone utilizing throat vibration can efficiently pick up a faint voice and in that the earphone 33 and microphone 34 separately provided do not cause acoustic interference or crosstalk. However, since the microphone 34 is pressingly attached to the user's throat by wrapping the supporter 35 around his neck, the user feels pressure on his neck. This hinders easy utterance and gives the user uncomfortable feeling in usage. Further, the microphone 34 moves out of position and may suffer from noise resulting from the rustling of the user's clothing. In addition, the apparatus is poor in appearance.

[0009] WO-A-9410818, according to which the preamble of claim 1 has been delimited, discloses a personal sound amplification system comprising a microphone, a loudspeaker and an amplifier having an input connected to the microphone and an output connected to the loudspeaker. The microphone is incorporated in an earpiece which is adapted for positioning in the ear canal of a user so as to pick up sound from the ear canal; and the loudspeaker is adapted for positioning in the region of the other outer ear of the user for generating sound thereto. The apparatus may be used with a radio transmitter receiver, the output of which is supplied to the loudspeaker. The output of the microphone may also be transmitted in radiographic form. Moreover, the apparatus may be used in telecommunications as a hands-free transmitting/receiving device.

[0010] WO-A-9405231 discloses an ear based haring protector and communication system with a transmitting receiving apparatus. Ear muffs or earplugs are fitted with a transducer and a microphone to transmit and receive speech. The disclosed microphone is based on air conduction and has partially as goal to minimize reception of bone conducted vibration.

[0011] An ear microphone for an external auditory canal insertion type two-way communication earpiece is disclosed in EP-A-0107843. A casing of the earpiece contains a fixed electrode and a vibrating electrode positioned in capacitive relation to each other, the vibrating electrode detecting acceleration vibration from outside the casing in the form of bone conducted voice sound vibration within the external auditory canal.

[0012] Object of the present invention is to provide an improved, comfortable hands-free transmitting/receiving apparatus for use in telecommunications which is free from howling and crosstalk, although presenting high sensitivity and an excellent voice reproduction caracteristic.

[0013] To achieve this object present invention provides a transmitting receiving apparatus for use in telecommunications, comprising a first ear-insertion body serving as an earphone for insertion into one ear of a user; a second ear-insertion body provided separately from the first ear-insertion body for insertion into the other ear of a user and serving as a microphone, characterised in that the microphone is a capacitor microphone of a bone-conduction type and has a vibration electrode, said second ear insertion body comprising a body casing incorporating said microphone, an insertion cover adjoining with the body casing and having a configuration such that the outer periphery of the insertion cover contacts a user's external auditory meatus when the second ear insertion body is inserted in a user's ear, and a vibration conduction member connected to the central

portion of said vibration electrode at one end and to the insertion cover at the other end.

[0014] With the aforesaid construction, the transmitting/receiving apparatus drives the earphone by sending a receiving signal to the first ear-insertion body and transmits a transmitting signal from the microphone of the second ear-insertion body via a wire or over wireless utilizing a radio wave or ultrasonic wave. The microphone of the second ear-insertion body receives a voice signal from the user's external auditory meatus through bone conduction and assuredly catches even a faint voice as a voice signal. The second ear-insertion body is provided separately from the first ear-insertion body and, therefore, such problems as howling and crosstalk between the microphone and the earphone can be avoided. Further, the transmitting/receiving apparatus of the present invention frees the user's hands.

[0015] The insertion cover may be formed of a rigid resin and the vibration conduction member may be formed of a metal having a specific gravity of between 5kg/dm^3 to 20 Kg/dm^3.

[0016] The invention will now be described in more detail and by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a perspective view illustrating the appearance of a transmitting/receiving apparatus for use in telecommunications in accordance with an embodiment of the invention;

Figure 2 is a sectional view illustrating a second ear-insertion body of the transmitting/receiving apparatus which serves as a microphone;

Figure 3 is an electrical circuit diagram of the second ear-insertion body;

Fig. 4 is a perspective view illustrating the appearance of a transmitting/receiving apparatus for use in telecommunications in accordance with another embodiment of the present invention;

Fig. 5 is a sectional view illustrating a second ear-insertion body of the transmitting/receiving apparatus shown in Fig. 4 which serves as a microphone;

Fig. 6 is a perspective view illustrating a conventional transmitting/receiving apparatus for use in telecommunications;

Fig. 7 is a sectional view illustrating another conventional transmitting/receiving apparatus; and

Fig. 8 is a perspective view illustrating still another conventional transmitting/receiving apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] With reference to the attached drawings, the present invention will hereinafter be described in detail by way of embodiments thereof.

[0018] Referring to Fig. 1, a transmitting/receiving apparatus includes a first ear-insertion body 1 having an electric/vibration conversion element (not shown) incorporated therein to serve as an earphone, and a second ear-insertion body 2 serving as a bone-conduction microphone. The first and second ear-insertion bodies 1 and 2 are connected to an adjuster 5 via wires 3 and 4. The adjuster 5 is connected to a handy phone 8 with a plug 7 of the wire 6 being inserted into a jack of the handy phone 8. The adjuster 5 has an amplifier, equalizer, volume adjuster and the like incorporated therein.

[0019] The second ear-insertion type body 2 serving as a bone-conduction microphone has a structure as shown in Figure 2. Specifically, the second ear-insertion body 2 includes a body casing 9 formed of a synthetic resin, an insertion cover 10 provided at a front end of the body casing 9 and formed of a relatively rigid resin selected from silicone resins or polyvinylchloride resins into a configuration such that the outer periphery thereof contacts an external auditory meatus of a user's ear, a rear end cover 11 provided at the rear end of the body casing 9, and a vibration sensor 12 supported by a support member 13 in a body casing 9. A vibration bar 14 serving as a vibration conduction member and connected to a vibration element of the vibration sensor 12 extends to the front end of the body casing 9 and is connected to the interior surface of a side portion of the insertion cover 10. A soft silicone rubber 15 which does not hinder the vibration of the vibration bar 14 is provided around the vibration bar 14. The second ear-insertion body 2 has a vent hole 16 extending through rear end cover 11, support member 13 and insertion cover 10. A wire 17 is connected to a terminal of the vibration sensor 12.

[0020] The vibration sensor 12 comprises a capacitor microphone as shown in Fig. 3. More specifically, the vibration sensor 12 includes a vibration electrode 18, a solid electrode 19 and a dielectric 20 interposed therebetween, and the vibration bar 14 is connected to the vibration electrode 18.

[0021] In this embodiment, the vibration bar 14 has a diameter of 1.6mm and a length of 10mm and is formed of a metal such as stainless steel or iron, which has a specific gravity of about 5kg/dm^3 to about 20kg/dm^3.

[0022] In use, the first ear-insertion body 1 serving as an earphone is inserted into one ear, and the second ear-insertion body 2 serving as a bone-conductive microphone is inserted into the other ear. The first ear-insertion body 1 receives a transmitted electric signal and converts it into audio vibration thereby serving as an earphone. In the second ear-insertion body 2, a voice uttered is transferred by bone conduction to the vibration bar 14 (vibration conductor member) via the insertion cover 10 contacting the user's external auditory meatus. The vibration electrode 18 is vibrated by the vibration of the vibration bar 14, and the voice is converted into audio/electric signals based on the capacity variation of a capacitor incorporated in the second ear-insertion body 2. The signals thus generated are transmitted from the second ear-insertion body 2.

[0023] Thus, the transmitting/receiving apparatus of

the present invention achieves the transmission and reception of audio information. Since the first ear-insertion body 1 serving as an earphone and the second ear-insertion body 2 serving as a microphone are both inserted in the user's ears, the user can freely use his hands to perform other manual operations. Further, the first ear-insertion body 1 serving as an earphone and the second ear-insertion body 2 serving as a microphone are separately provided and, therefore, the howling and cross-talk will never occur. Further, since the second ear-insertion body 2 incorporating the microphone is inserted into one ear, the second ear-insertion body 2 does not pick up any external noise. Particularly, the capacitor microphone has a sensitivity higher than that of a conventional acceleration sensor, thereby being capable of reproducing a voice close to an original voice. Thus, an excellent voice reproduction characteristic of the capacitor microphone allows the second ear-insertion body 2 to transmit a clear voice signal.

[0024] The insertion cover 10 of the second ear-insertion body 2 is formed of a rigid resin, and the vibration bar 14 connected thereto is made of a metal having a specific gravity of about 5kg/m^3 to about 20kg/dm^3. Therefore, even a faint voice is efficiently conveyed as a vibration through the user's external auditory meatus. Thus, the second ear-insertion body 2 serves as an effective bone-conduction microphone.

[0025] Further, there is no need to attach the microphone to the user's throat as in the prior art, because the second ear-insertion body 2 serving as a microphone provided separately from the earphone is inserted into the user's ear. Therefore, the user feels neither pressure on the throat and nor inconvenience in uttering a voice. Furthermore, any supporting member is not required.

[0026] Fig. 4 shows a transmitting/receiving apparatus for use in telecommunications in accordance with a second embodiment of the present invention. This transmitting/receiving apparatus is characterized by its cordless configuration which is embodied without the need to provide a wire as provided in the aforesaid first embodiment.

[0027] As shown, a first ear-insertion body 1 has a first receiver 21 disposed therein and connected to an audio conversion element. A second ear-insertion body 2 has a first transmitter 22 disposed therein and connected to a microphone element. A handy phone has a second transmitter 23 for transmitting to the first receiver 21 and a second receiver 24 for receiving from the first transmitter 22. The output of a radio signal herein employed is weak such that the radio wave reaches within several meters.

[0028] Fig. 5 is a sectional view illustrating one example of the second ear-insertion body 2 serving as a microphone. As shown, the second ear-insertion body 2 has the second transmitter 23 connected to a vibration sensor within a rear cover 11, a battery 25 for driving the apparatus, and an antenna chip 26 made of a metal and exposed on an outer surface of the rear cover 11. Since the transmitting/receiving apparatus of the second embodiment is of the so-called cordless type, a user can conveniently use the transmitting/receiving apparatus without being disturbed by the wire.

[0029] Although the transmitting/receiving apparatus according to the foregoing embodiments are designed to be used with a handy phone, they can be effectively used with an ordinary stationary telephone or a transceiver. In addition, it is possible to use ultrasonic waves instead of radio waves as transmitting medium, without causing any disadvantage.

[0030] As can be understood from the foregoing, the first ear-insertion body serving as an earphone and the second ear-insertion body serving as a microphone are separately provided in the transmitting/receiving apparatus in accordance with the present invention, and the microphone is of a bone-conduction type. Therefore, the transmitting/receiving apparatus frees user's hands, and does not cause such problems as howling and crosstalk. In addition, the user can comfortably use the receiving/transmitting apparatus without feeling pressure on the throat.

[0031] The second ear-insertion body serving as a microphone has the insertion cover formed of a rigid material and the vibration bar connected thereto and formed of a metal having a high specific gravity. Therefore, the second ear-insertion body can efficiently receive bone vibration conveyed through the user's external auditory meatus. Further, the second ear-insertion body incorporating the capacitor microphone as the vibration sensor has excellent frequency characteristics, thereby permitting clear voice to be received and transmitted. Thus, the transmitting/receiving apparatus of the present invention offers great practical advantages.

[0032] While only certain presently preferred embodiments of the invention have been described in detail, as will be apparent to those familiar with the art, certain changes and modifications can be made in embodiments without departing from the scope of the invention as defined by the following claims.

Claims

1. A transmitting/receiving apparatus for use in telecommunications, comprising:

   a first ear-insertion body (1) serving as an earphone for insertion into one ear of a user;
   a second ear-insertion body (2) provided separately from the first ear-insertion body (1) for insertion into the other ear of a user and serving as a microphone, **characterised in that** the microphone is a capacitor microphone of a bone-conduction type and has a vibration electrode (18), said second ear insertion body (2) comprising a body casing (9) incorporating said mi-

crophone, an insertion cover (10) adjoining with the body casing (9) and having a configuration such that the outer periphery of the insertion cover (10) contacts a user's external auditory meatus when the second ear insertion body (2) is inserted in a user's ear, and a vibration conduction member (14) connected to the central portion of said vibration electrode (18) at one end and to the insertion cover (10) at the other end.

2. A transmitting/receiving apparatus as claimed in claim 1, wherein the insertion cover (10) is formed of a rigid resin and the vibration conduction member (14) is formed of a metal having a specific gravity of between 5Kg/dm^3 to 20 Kg/dm^3.

3. A transmitting/receiving apparatus as claimed in claim 1 or 2, wherein the first ear-insertion body (1) has a receiver (21) adapted to receive a radio wave signal or an ultrasonic wave signal, and the second ear-insertion body (2) has a transmitter (22) adapted to transmit a radio wave signal or an ultrasonic wave signal.

Patentansprüche

1. Übertragungs-/Empfangs-Vorrichtung zur Verwendung in der Telekommunikation mit

einem ersten Ohr-Einführungs-Körper (1), welches als Ohrhörer zum Einführen in ein Ohr eines Benutzers dient;
einem zweiten Ohr-Einführungs-Körper (2), der separat ist von dem ersten Ohr-Einführungs-Körper (1) zur Einführung in das andere Ohr eines Benutzers und als Mikrofon dient,

dadurch gekennzeichnet, dass das Mikrofon ein Kondensator-Mikrofon des Knochenleitungstyps ist und eine Vibrationselektrode (18) aufweist, wobei der zweite Ohr-Einführungs-Körper (2) ein Körpergehäuse (9), welches das Mikrofon aufnimmt, eine Einführungsabdeckung (10) die benachbart zu dem Körpergehäuse (9) ist, und eine solche Konfiguration aufweist, dass der äußere Umfang der Einführungsabdeckung (10) einen äußeren Gehörgang eines Benutzers berührt, wenn der zweite Ohr-Einführungs-Körper (2) in das Ohr eines Benutzers eingeführt ist, und dass ein Vibrationsleitungselement (14) mit dem zentralen Abschnitt der Vibra-tionselektrode (18) an einem Ende und mit der Einführungsabdeckung (10) an dem anderen Ende verbunden ist.

2. Übertragungs-/Empfangs-Vorrichtung nach Anspruch 1, bei der die Einführungsabdeckung (10) aus einem festen Harz gebildet ist und das Vibrationsleitungselement (14) aus einem Metall gebildet ist, das ein spezifisches Gewicht zwischen 5 kg/dm^3 bis 20 kg/dm^3.

3. Übertragungs-/Empfangs-Vorrichtung nach Anspruch 1 oder 2, bei der der erste Ohr-Einführungs-Körper (1) einen Empfänger (21) aufweist, der angepasst ist, um Radiowellensignale oder ein Ultraschallwellensignal zu empfangen, und der zweite Ohr-Einführungs-Körper (2) einen Übertrager (22) aufweist, der angepasst ist, um ein Radiowellensignal oder ein Ultraschallwellensignal zu übertragen.

Revendications

1. Appareil d'émission/réception prévu pour être utilisé en télécommunications, comprenant :

Un premier corps d'insertion dans l'oreille (1) utilisé comme appareil auditif pour être inséré dans une oreille d'un utilisateur,
Un deuxième corps d'insertion dans l'oreille (2) prévu, séparément du premier corps d'insertion dans l'oreille (1), pour être inséré dans l'autre oreille d'un utilisateur et servant de microphone,

caractérisé en ce que le microphone est un microphone à condensateur du type à conduction osseuse et comprend une électrode à vibrations (18), ledit deuxième corps d'insertion dans l'oreille (2) comprenant un boîtier de corps (9) dans lequel est logé ledit microphone, un couvercle d'insertion (10) contigu au boîtier (9) de corps et présentant une configuration telle que la périphérie extérieure du couvercle d'insertion (10) vient en contact du méat acoustique externe d'un utilisateur lorsque le deuxième corps d'insertion (2) dans l'oreille est inséré dans l'oreille de l'utilisateur, et un élément de conduction des vibrations (14) relié à la partie centrale de ladite électrode à vibrations (18) à une extrémité et au couvercle d'insertion (10) au niveau de l'autre extrémité.

2. Appareil d'émission/réception selon la revendication 1, dans lequel le couvercle d'insertion (10) est formé d'une résine rigide et l'élément de conduction des vibrations (14) est formé d'un métal présentant une gravité spécifique comprise entre 5 kg/dm3 et 20 kg/dm3.

3. Appareil d'émission/réception selon la revendication 1 ou la revendication 2, dans lequel le premier corps d'insertion (1) comporte un récepteur (21)

adapté pour recevoir un signal d'onde radio ou un signal d'onde ultrasonore, et le deuxième corps d'insertion (2) dans l'oreille comporte un émetteur (22) adapté pour transmettre un signal d'onde radio ou un signal d'onde ultrasonore.

Fig.1

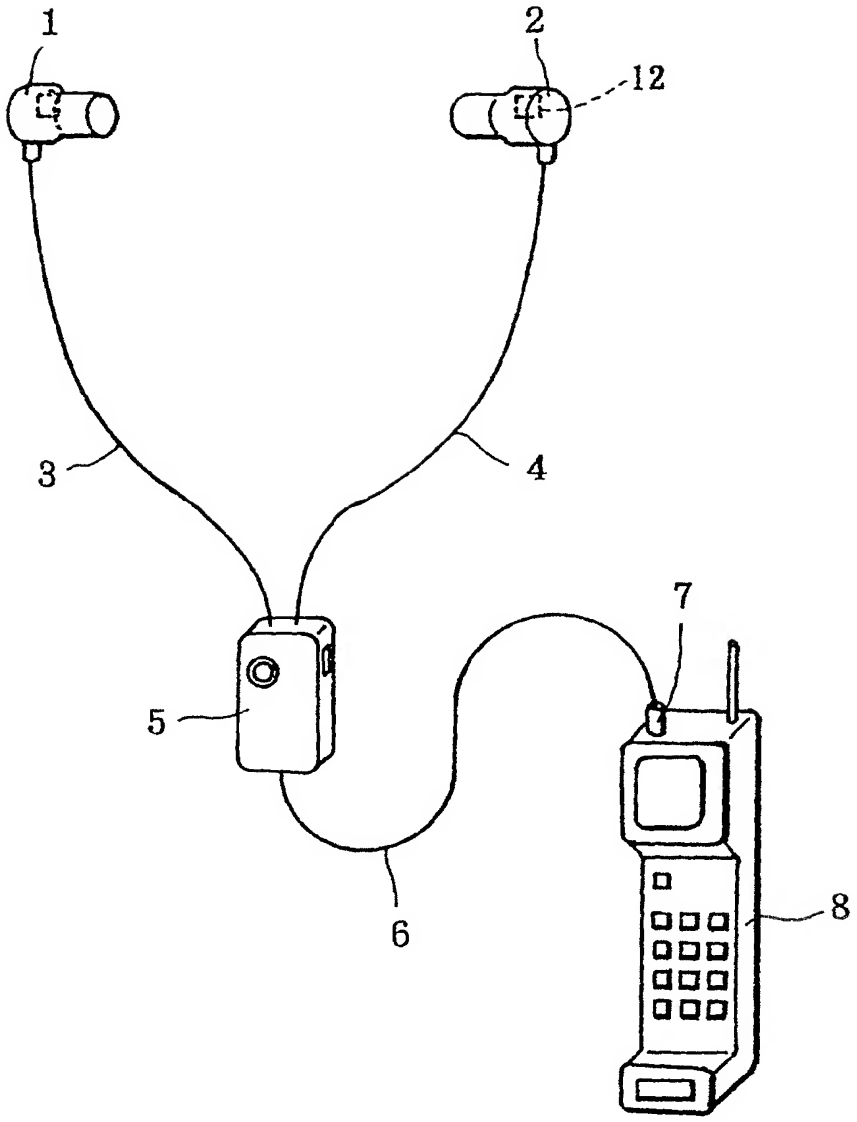

Fig.2

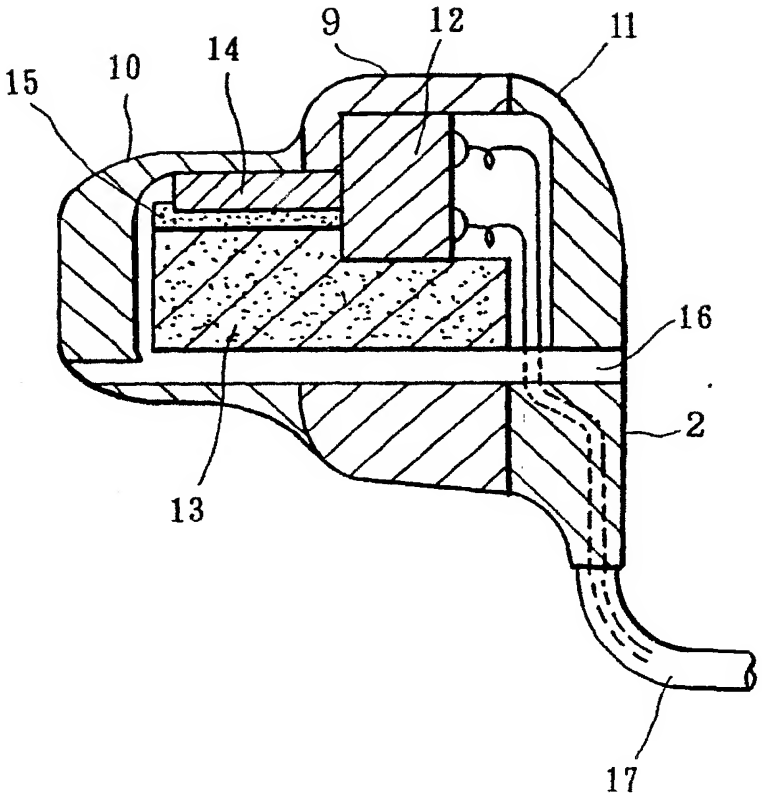

Fig.3

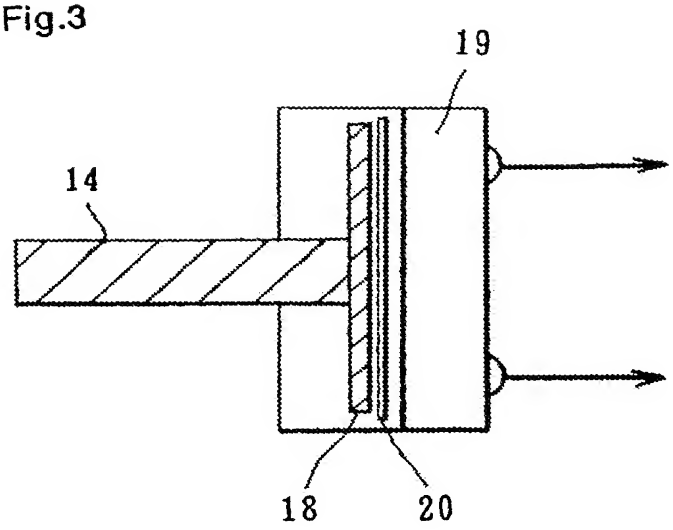

Fig.4

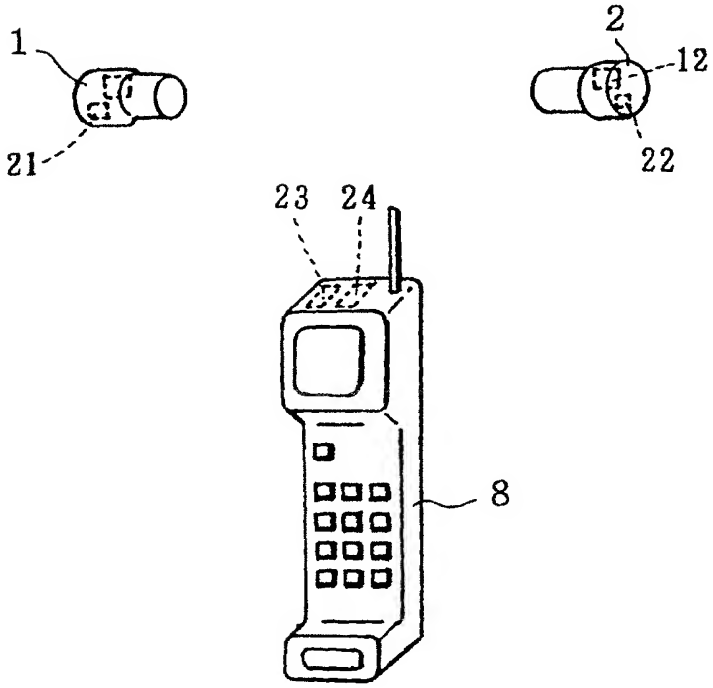

Fig.5

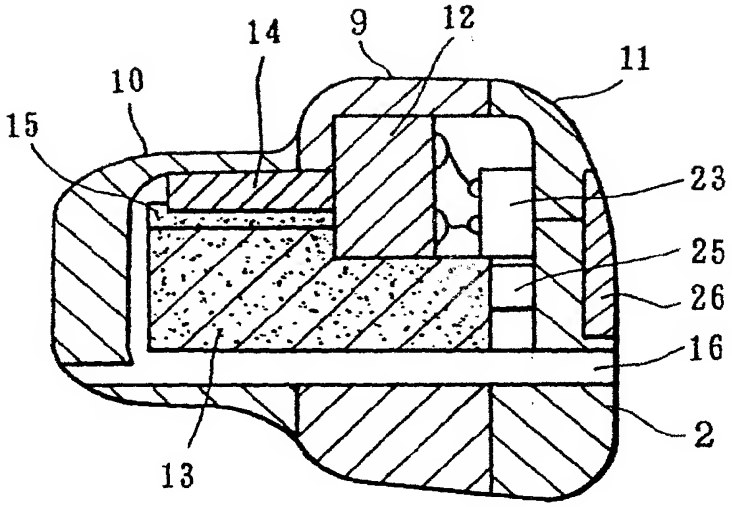

Fig.6

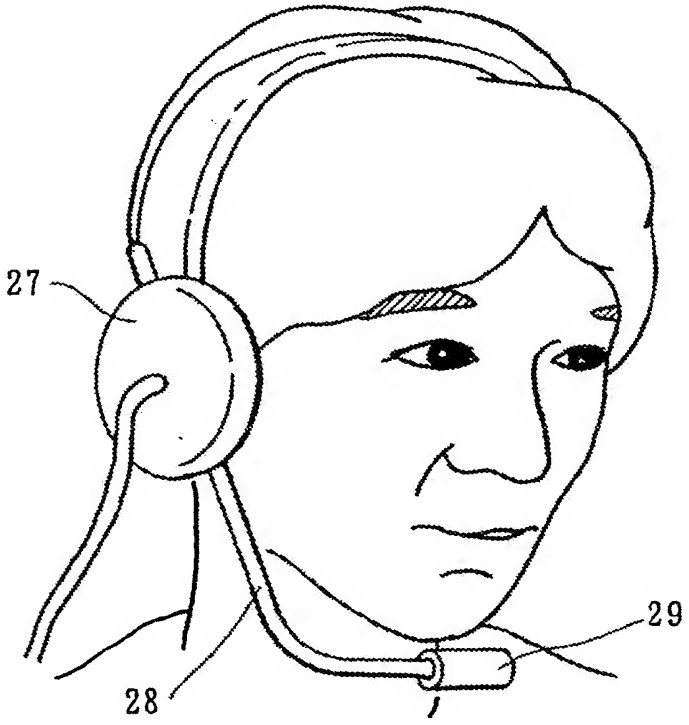

Fig.7

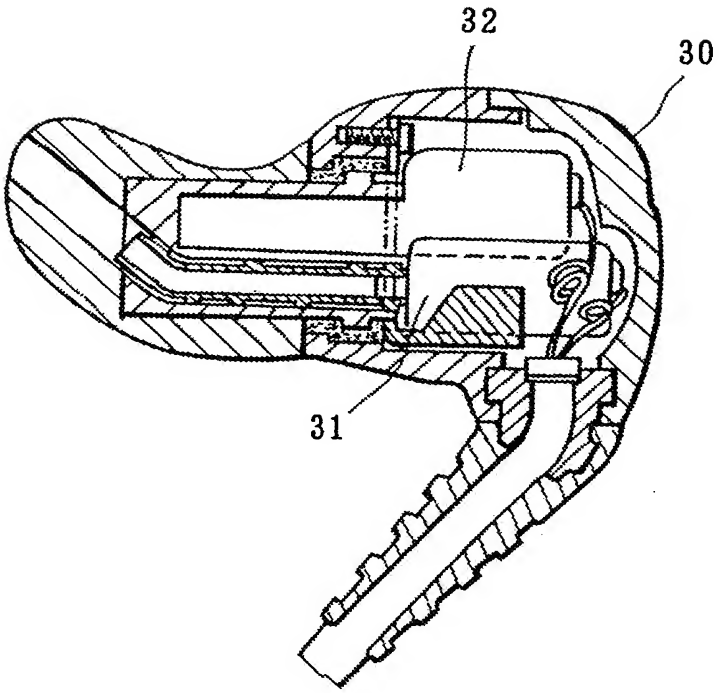

Fig.8